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FURTHER STUDIES OF THE TERTIARY OTOLITHS OF VICTORIA, AUSTRALIA

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Abstract

Descriptions of the otoliths of 3 new teleosteans are given, together with a record of the occurrence at many new localities of the species previously described by the author in 1958. Taxonomic notes are also included.

Introduction

Since the publication of descriptions of Tertiary teleost otoliths from strata in Victoria, Australia, in 1958, a further series of otoliths has been submitted by the National Museum of Victoria to the author for examination. These establish the occurrence, at many new localities, of species already described. In addition, 3 new forms are represented and these are described hereunder.

The following analysis of the 299 specimens received records their frequency and the localities at which they occur:

Janjukian (No. of specimens given in brackets after each name.)

(a) Bird Rock Cliffs (zone 3), Torquay. F. A. Cudmore Colln.
Sillago pliocaenica Stinton (2)

(b) Spring Cr. (Ledge), Torquay. T. S. Hall Colln.
Megalops lissa Stinton (7)
Pterothrissus pervetustus Stinton (5)
Uroconger rectus (Frost) (16)
Heterenchelys regularis Stinton (1)
Coelorhynchus elevatus Stinton (13)
Merluccius fimbriatus Stinton (2)
Gadus refertus Stinton (1)
Ophidion granosum Stinton (6)
Cleidopus cavernosus Stinton (1)
Trachichthodes salebrosus Stinton (1)
Sillago pliocaenica Stinton (76)

(c) Gellibrand. T. S. Hall Colln.
Heterenchelys regularis Stinton (2)
Trachichthodes salebrosus Stinton (3)

Balcombian

(d) Section 2B, Murgheboluc. F. A. Cudmore Colln.
Heterenchelys regularis Stinton (3)
Trachichthodes salebrosus Stinton (1)

(e) Tunnel Dump, Fyansford. F. A. Cudmore Colln.
Heterenchelys regularis Stinton (1)
Uroconger rectus (Frost) (1)
Trachichthodes salebrosus Stinton (1)

(f) Grice's Cr., Mornington. F. A. Cudmore Colln.
Heterenchelys regularis Stinton (5)
Coelorhynchus elevatus Stinton (3)
Gadus refertus Stinton (1)
Merluccius fimbriatus Stinton (16)
Ophidion granosum Stinton (2)

Jordanicus exiguus Stinton (3)
Cleidopus cavernasus Stinton (2)
Trachichthodes salebrosus Stinton (3)
Antigania fornicata n. sp. (1)
Sillaga pliacaenica Stinton (2)
Sebastodes fissicostatus n. sp. (4)

(g) Inverleigh. F. A. Cudmore Colln.
Heterenchelys regularis Stinton (1)
Ophidion granasum Stinton (1)

(h) Clifton Bank, Muddy Cr., Hamilton. T. S. Hall Colln.
Hypomesus glaber n. sp. (1)
Heterenchelys regularis Stinton (12)
Merluccius fimbriatus Stinton (1)
Sillaga pliocaenica Stinton (43)
Sebastodes fissicostatus n. sp. (1)

(i) Hexham. T. S. Hall Colln.
Sillago pliocaenica Stinton (1)

(j) Filter Quarries, Spring Cr., Birregurra. T. S. Hall Colln.
(Specimens from the three localities in one tube and not separable. Janjukian-Batesfordian.)
Heterenchelys regularis Stinton (3)
Ophidian granasum Stinton (1)
Trachichthodes salebrosus Stinton (5)
Sillago pliocaenica Stinton (9)
Lactarius tumulatus Stinton (5)

(k) Exposure on road by Cheese Factory, Port Campbell. T. S. Hall Colln.
Trachichthades salebrosus Stinton (4)

(l) Grice's Cr., Mornington. T. S. Hall Colln. (from F. Chapman)
Bregmaceros minutus Stinton (3)
Ophidian granosum Stinton (1)

BAIRNSDALIAN

(m) Rutledge's Beach, Port Campbell, T. S. Hall Colln.
Uraconger rectus (Frost) (1)
Sillago pliacaenica Stinton (3)

CHELTENHAMIAN

(n) Beaumaris (above nodule bed). F. A. Cudmore Colln.
Sillago pliacaenica Stinton (17)
Lactarius tumulatus Stinton (1)

Systematic Description of Species

Sub-Class ACTINOPTERYGII

Super Order TELEOSTEI

Order ISOSPONDYLI

Family ELOPSIDAE

Genus **Megalops** Lacépède 1803

Megalops lissa Stinton 1958

LOCALITY: (b).

Family PTEROTHRISSIDAE

Genus **Pterothrissus** Hilgendorf 1877

Pterothrissus pervetustus Stinton 1958

LOCALITY: (b).

Family Argentinidae

Genus **Hypomesus** Gill 1862

Hypomesus glaber n. sp.

(Fig. 1)

Holotype: Nat. Mus. Vict. P21832. Left sagitta otolith, inner face. x 6. Clifton Bank, Muddy Cr., Hamilton, Vict., T. S. Hall Coll.

Dimensions: Length 3·96 mm. Width 2·76 mm. Unique specimen.

Description: A thickened, ovate, left sagitta otolith. Dorsal rim flattened and faintly scalloped; vertical, short, faintly scalloped posterior rim; rounded, finely

Fig. 1

serrated ventral rim; oblique, notched anterior rim. Smooth, thickened outer face with faint, short radial ribs on the dorsal, posterior and postero-ventral rims. Anterior part of the ventral rim strongly compressed to form a narrow, prominent shelf. A smooth, convex inner face with a median sulcus opening on the anterior rim and not quite reaching the posterior rim. Sulcus consisting of a short, narrow, triangular ostium which tapers to a point at its junction with the somewhat wider, deeper and long cauda. Cauda tapering to a slightly turned-down point at its extremity. Indistinct upper and lower angles at junction of ostium and cauda. Crista superior accentuated by a shallow depression above it. Prominent rostrum; anti-rostrum accentuated by a notch. Slight excisura. No colliculi present.

This otolith compares well with otoliths of the living *Hypomesus japonicus* Brevoort, both in the characters of the sulcus, the pronounced rostrum and the general outline but it differs in the higher anterior end of the dorsal rim.

Order Apodes

Family Congridae

This family is assigned to Leptocephalidae by Munro ('Handbook of Australian Fishes') but this is invalid for the following reasons: In Opinion 44 of the International Rules of Zoological Nomenclature, the Commission recognized *Leptocephalus* Gronovius 1763, as the genus for conger eels. However, in Opinion 93 this was reversed and the Commission recognized the genus *Conger* Cuvier 1817, designating the name *Leptocephalus* to the larval forms. Direction 87 of the International Commission on Zoological Nomenclature, February 1958, deleted the name *Conger* Cuvier 1817, as ruled in Opinion 93, from the official list of generic names in zoology and in its place inserted *Conger* Oken 1817 (gender: masculine) with the type species *Muraena conger* Linnaeus 1758 by absolute tautonomy.

Genus **Uroconger** Kaup 1856

Uroconger rectus (Frost) 1928

Localities: (b), (e), (m).

Family Heterenchelyidae

Genus **Heterenchelys** Regan 1912

Heterenchelys regularis Stinton 1958

Localities: (b), (c), (d), (e), (f), (g), (h), (j).

Order Anacanthini

Family Merlucciidae

Genus **Merluccius** Refinesque 1810

Merluccius fimbriatus Stinton 1958

Localities: (b), (f), (h).

Family Gadidae

Genus **Gadus** Linnaeus 1758

Gadus refertus Stinton 1958

Localities: (b), (f).

Family Bregmacerotidae

Genus **Bregmaceros** (Cantor) Thompson 1840

Bregmaceros minutus Stinton 1958

Locality: (l).

Family Corypiiaenoididae

Genus **Coelorhynchus** Giorna 1803

Coelorhynchus elevatus Stinton 1956

Localities: (b), (f).

Sub-order Ophidioidea

(For reasons for the changed position of this sub-order in the systematics see Stinton.)

Family Carapidae

Genus **Jordanicus** Gilbert 1905

Jordanicus exiguus Stinton 1956

Locality: (f).

Family Ophidiidae

Genus **Ophidion** Linnaeus 1758

Ophidion granosum Stinton 1958

Localities: (b), (f), (g), (j).

Order Berycomorphi

Family Monocentridae

Genus **Cleidopus** de Vis 1883

Cleidopus cavernosus Stinton 1958

Locality: (f).

Family Trachichthyidae

Genus **Trachichthodes** Gilchrist 1903

In 1911 McCulloch (*Biol. Res. Endeavour* I (1)) placed *affinis, gerrardi* and *lineatus* in *Austroberyx* gen. nov., selecting *affinis* as the type. However, Barnard (*Ann. S. Afr. Mus.* 21: 363, 1925) remarks that *T. spinosus*, Gilchrist's type for his genus *Trachichthodes* is so close to *T. lineatus* Cuv. et Val., that it seems scarcely worthy of specific rank. In 1948 Whitley (*Fish. Bull. W.A.* 2: 16) renamed *Trachichthodes affinis Centroberyx affinis* but gave no reasons for the change in nomenclature. This latter name was also used by Munro in 'The Handbook of Australian Fishes' (Fisheries Newsletter) but again no reason is offered for the change. It should be noted that the orthotype of *Centroberyx* Gill (*Proc. Acad. Nat. Sci. Philad.* 1862: 238) is *Beryx lineatus* Cuv. et Val., and that Munro has retained *lineatus* in the genus Trachichthodes. Regan (*Ann. Mag. Nat. Hist.* (9) VII, 1921: 4, Pl. I) places *affinis* in the genus *Hoplopteryx* in the *Berycidae* while Roule (1924) makes *Trachichthodes, Austroberyx* and *Hoplopteryx* all synonyms of *Centroberyx* Gill. However, as *Hoplopteryx* is the oldest genus this cannot be a synonym of *Centroberyx*.

A study of the otoliths of *Trachichthodes affinis* proves conclusively that this species is not referable to the *Berycidae* sensu stricto but, in fact, is closely allied to the *Monocentridae*. Comparisons between the otoliths of the above species and those of *Monocentris japonicus* show sufficient distinctions for separation of the two groups and, with the evidence at present available, it is considered that *Trachichthodes* is the valid genus for *affinis*.

Trachichthodes salebrosus Stinton 1958

Localities: (c), (d), (e), (f) ,(j), (k).

Family Caproidae

Genus **Antigonia** Lowe 1843

1843 *Antigonia* Lowe *Proc. Zool. Soc. Lond.* 85.

Antigonia fornicata n. sp.

(Fig. 2)

Holotype: Nat. Mus. Vict. P21831. Right sagitta otolith, inner face. x 6. Grice's Cr., Mornington, Vict. F. A. Cudmore Coll.

Dimensions: Length 7·07 mm. Width 7·67 mm.

Description: A high, oval right sagitta otolith, higher than it is long. Dorsal rim short, rather flattened; high, rounded, slightly lobed posterior rim; deeply

rounded ventral rim, slightly denticulated on the posterior half; obtuse anterior rim with a very slight, rounded notch near its junction with the ventral rim. The slightly concave outer face is rugose, somewhat thickened and there is an irregular vertical groove extending from the dorsal rim to the centre of the otolith. A smooth, convex inner face with an horizontal sulcus traversing the otolith slightly above the mid-line, opening on the anterior rim and not quite reaching the posterior rim. The sulcus consists of a wide, shallow, oval ostium and a slightly longer, shallower cauda which is not so wide as the ostium and follows a slightly upward course. The cauda expands slightly near the posterior end but then tapers sharply to a rounded point. Junction of ostium and cauda marked by a prominent lower angle, accentuated by the depth of the ostium, and a slight, obtuse upper angle. Crista superior accentuated by a slight depression above it. A deep, semicircular lower area. No rostrum but a very slight antirostrum and excisura present. No colliculi.

Fig. 2

A cursory examination suggests that this otolith is referable to the Monocentridae but the sulcus differs materially from that seen in the otoliths of this family. In the genus *Antigonia*, however, the sulcus is very similar indeed to that of the fossil form which differs from the sagitta otolith of *Antigonia capros* Lowe, only in being more circular in outline.

A comparison of the otoliths of *Antigonia capros* Lowe, with those of *Capros aper* Linnaeus, shows that the former have marked Berycoid features which are not seen in the otoliths of the latter species. For this reason it is considered that *Antigonia* should be included in the Berycomorphi.

Order Percomorphi

Sub-Order Percoidea

Family Sillaginidae

Genus **Sillago** Cuvier 1817

Sillago pliocaenica Stinton 1952

Localities: (a), (b), (f), (h), (i), (j), (m), (n).

Family Lactariidae

Genus Lactarius Cuvier et Valenciennes 1883

Lactarius tumulatus Stinton

Localities: (j), (n).

Order Scleroparei

Family Scorpaenidae

Genus **Sebastodes** Gill 1861

1861 Gill *Proc. Ac. Nat. Sci. Phila.* 165.

Sebastodes fissicostatus n. sp.

(Fig. 3)

Holotype: Nat. Mus. Vict. P21822. Left sagitta otolith, inner face. x 6. Grice's Cr., Mornington, Vict. F. A. Cudmore Coll.

Paratypes: P21823-5, Grice's Cr., F. A. Cudmore Coll. P21826, Clifton Bank, Muddy Cr., Hamilton, Vict., T. S. Hall Coll.

Dimensions: Length 7·33 mm. Width 4·65 mm.

Description: An elliptical, left sagitta otolith. The rounded, short, scalloped dorsal rim is continuous with the posterior rim which is notched near the posterior point of the otolith; rounded ventral rim; short, oblique anterior rim, notched at the opening of the sulcus. Concave outer face ornamented with radial scalloping on

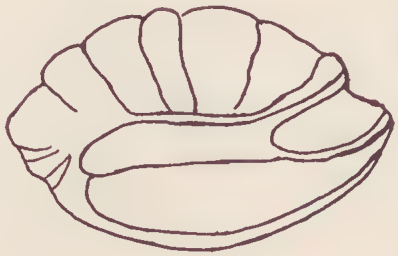

Fig. 3

the dorsal area which is slightly more hollowed-out than the ventral area. A small groove runs from the anterior rim to a central umbo. Convex inner face with a prominent median sulcus opening on the anterior rim and not quite reaching the posterior end of the otolith. Sulcus consisting of a rather short, deep, narrow, somewhat triangular ostium which is turned downwards, and a rather sinuous, horizontal, slightly narrower cauda which is slightly expanded near its posterior end, becoming slightly hooked at its termination. The crista superior and crista inferior are continuous in each case, the junction of ostium and cauda being marked only by a slight narrowing of the cristae. The crista superior is accentuated by a shallow depression above it, the depression being traversed by radiating ridges to the dorsal rim. A prominent rostrum, antirostrum and excisura present. No colliculi. A wide, smooth, semicircular area below the crista inferior.

This otolith shows an affinity with those of the genus *Sebastodes* Gill, especially the Californian species *Sebastodes paucispinis* Ayres, in its characteristic sulcus and the ornamented area above the sulcus. The otolith of the living species, however, is more elongate.

Conclusions

The accompanying tables summarize the stratigraphical range of the fossil teleosts of Victoria, represented by their otoliths, and their relationship to living species is also shown. It will be seen that most of the species have a moderate range while a few of them extend throughout the entire range of strata so that otoliths are of little zonal value.

In their relationship to living teleosts, a number of genera are still represented in Australian waters. With the exception of *Gadus*, which ranges from cold to

TABLE 1

Stratigraphical Range of Teleosts Represented by Otoliths

Species	Janjukian	Longfordian	Batesfordian	Balcombian	Bairnsdalian	Cheltenhamian	Kalimnan
Megalops lissa Stinton				×			
Hypomesus glaber Stinton				×			
Pterothrissus pervetustus Stinton	×						
Heterenchelys regularis Stinton	×			×			
Muraenesox obrutus Stinton				×			
Uroconger rectus (Frost)	×			×	×		×
Astroconger rostratus Stinton	×						
Merluccius fimbriatus Stinton	×			×			
Gadus refertus Stinton	×			×			
Bregmaceros minutus Stinton				×			
Coelorhynchus elevatus Stinton	×			×			
Jordanicus exiguus Stinton				×			
Ophidion granosum Stinton	×			×			
Monocentris sphaeroides Stinton				×			
Cleidopus cavernosus Stinton	×			×			
Trachichthodes salebrosus Stinton	×			×			
Antigonia fornicata Stinton				×			
'*Percidarum*' *clivosum* Stinton				×			
Sillago pliocaenica Stinton	×			×	×	×	S. Aust.
Lactarius tumulatus Stinton				×		×	
Platycephalus petalis Stinton					×		
Sebastodes fissicostatus Stinton				×			
Pleuronectes vulsus Stinton				×			

TABLE 2

Relationship of Fossil Telosts to Living Species

Order	Family	Species	Related Living Species	Common Name
ISOSPONDYLI	ELOPIDAE	*Megalops lissa* Stinton	*Megalops cyprinoides* Broussonet	'Ox-eye Herring'
	ARGENTINIDAE	*Hypomesus glaber* Stinton	*Hypomesus Japonicus* Brevoort	
	PTEROTHRISSIDAE	*Pterothrissus pervetustus* Stinton	*Pterothrissus belloci* Cadenat	
APODES	HETERENCHELYIDAE	*Heterenchelys regularis* Stinton		
	MURAENESOCIDAE	*Muraenesox obrutus* Stinton	*Muraenesox talabon* Cantor	
	CONGRIDAE	*Uroconger rectus* (Frost)	*Uroconger lepturus* Richardson	Tropical marine eels
		Astroconger rostratus Stinton	*Astroconger myriaster* Brevoort	
ANACANTHINI	MERLUCCIIDAE	*Merluccius fimbriatus* Stinton	*Merluccius vulgaris* Fleming	Hake
	GADIDAE	*Gadus refertus* Stinton	*Gadus luscus* Linnaeus	Pout Whiting
	BREGMACEROTIDAE	*Bregmaceros minutus* Stinton	*Bregmaceros atripinnis* Day	Unicorn cod
	CORYPHAENOIDIDAE	*Coelorhynchus elevatus* Stinton	*Coelorhynchus fasciatus* (Gunther)	Banded Whiptail
Sub-order: OPHIDIOIDEA	CARAPIDAE	*Jordanicus exiguus* Stinton	*Jordanicus gracilis* Bleeker	Pearl Fish
	OPHIDIIDAE	*Ophidion granosum*		
PERCOMORPHI Sub-order:— PERCOIDEA		*'Percidarum' clivosum* Stinton	?	
	SILLAGINIDAE	*Sillago pliocaenica* Stinton	*Sillago sihama* Forskål	'Whiting'
	LACTARIIDAE	*Lactarius tumulatus* Stinton	*Lactarius lactarius* Bloch & Schneider	Milk Trevally
SCLEROPAREI	PLATYCEPHALIDAE	*Platycephalus petalis* Stinton	*Platycephalus insidiator* Forskål	Flathead
	SCORPAENIDAE	*Sebastodes fissicostatus* Stinton	*Sebastodes paucispinis* Ayres	Surf fish
HETEROSOMATA	PLEURONECTIDAE	*Pleuronectes vulsus* Stinton		Flounder

subtropical waters in the northern hemisphere, all the genera are tropical in their habitats, although *Merluccius* and *Coelorhynchus* are confined to the benthic zones in tropical seas. The addition to the list of the 3 new species does not materially alter the conclusions postulated by the author in 1958. *Antigonia* is a pelagic form while *Hypomesus* and *Sebastodes* inhabit littoral zones so that all could be found at varying depths.

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